UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/899,843	07/09/2001	Eilon Riess	11927/46101	6082

23838 7590 06/17/2005

KENYON & KENYON
1500 K STREET NW
SUITE 700
WASHINGTON, DC 20005

EXAMINER	
THANGAVELU, KANDASAMY	
ART UNIT	**PAPER NUMBER**
2123	

DATE MAILED: 06/17/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/899,843	<Unknown>
	Examiner	Art Unit
	Kandasamy Thangavelu	2123

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 July 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-75* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-46,48-54 and 56-75* is/are rejected.

7)☒ Claim(s) *47 and 55* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 July 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *7/9/01, 9/12/02*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☒ Other: *See Continuation Sheet*.

Continuation of Attachment(s) 6). Other: (1449) 10/10/01, 12/27/01 and 12/23/02.

DETAILED ACTION

1. Claims 1-75 of the application have been examined.

Foreign Priority

2. Acknowledgment is made of applicant's claim for foreign priority based on application 16938.3 filed on July 10, 2000 in UK and PCT application 00/02634 filed on July 10, 2000. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

3. Acknowledgment is made of the information disclosure statements filed on July 9, 2001, September 12, 2001, October 10, 2001, December 27, 2001 and December 23, 2002 together with copies of various papers. The patents and papers have been considered.

Drawings

4. The drawings submitted on July 9, 2001 are accepted.

Specification

5. The disclosure is objected to because of the following informalities:

Page 2, Para 4, Line 10, "$a_{-K1}, \dots a_{K2}$ represent the sampled values of the impulse response of the channel" appears to be incorrect and it appears that it should be "d_{n-i} represent decoded data symbols of the channel".

Page 7, Para 27, Line 5, "$R(x_n) = \sum_{i=-k1, i \neq 0}^{k2} \mid d^\wedge_{n-i} \mid c_i$, (11)" appears to be incorrect and it appears that it should be "$R(x_n) = \sum_{i=1}^{k} \mid d^\wedge_{n-i} \mid c_i$, (11)".

Appropriate correction is required.

Claim Objections

6. The following is a quotation of 37 C.F.R § 1.75 (d)(1):

> The claim or claims must conform to the invention as set forth in the remainder of the specification and terms and phrases in the claims must find clear support or antecedent basis in the description so that the meaning of the terms in the claims may be ascertainable by reference to the description.

7. Claims 12-18 are objected to under 37 CFR 1.75 as being substantial duplicates of claims 3-9. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

8. Claims 22, 23 and 31 are objected to because of the following informalities:

8.1 In Claim 22, Lines 6-7, "the second weight being is proportional to the reliability factor of the candidate sample" appears to be incorrect and it appears that it should be "the second weight being proportional to the reliability factor of the candidate sample".

8.2 In Claim 23, Lines 6-7, "the second weight being is proportional to the reliability factor of the candidate sample" appears to be incorrect and it appears that it should be "the second weight being proportional to the reliability factor of the candidate sample".

8.3 In Claim 31, Line 5, "K represents a number of samples neighboring to the sample x_n" appears to be incorrect and it appears that it should be "K represents a number of decoded symbols neighboring to the sample x_n".

Appropriate corrections are required.

Claim Rejections - 35 USC § 112

9. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10. Claims 38, 50, 58 and 67 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In Claims 38, 50, 58 and 67, the variables x_n, σ, y, and a are undefined, making the claims vague and indefinite.

Claim Rejections - 35 USC § 101

11. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

12. Claims 1-9, 10-18, 19-43, 59-68 and 69-75 are rejected under 35 U.S.C. 101 because the claimed inventions are directed to non-statutory subject matter.

12.1 Method claims 1-9 are rejected for reciting a process that is not directed to the technological arts.

Regarding claim 1, this claim is directed at a reliable symbol identification method, whereas none of the limitations describe any type of computer-implemented steps. To be statutory, the utility of an invention must be within the technological arts. *In re Musgrave*, 167 USPQ 280, 289-90 (CCPA, 1970). The definition of "technology" is the "application of science and engineering to the development of machines and procedures in order to enhance or improve human conditions, or at least to improve human efficiency in some respect." (Computer Dictionary 384 (Microsoft Press, 2d ed. 1994)).

Dependent claims 2-9 depend on Claim 1 but do not add further statutory steps.

The limitations recited in claims 1-9 contain no language suggesting these claims are intended to be within the technological arts.

12.2 Method claims 10-18 are rejected for reciting a process that is not directed to the technological arts.

Regarding claim 10, this claim is directed at a reliable symbol identification method, whereas none of the limitations describe any type of computer-implemented steps. To be statutory, the utility of an invention must be within the technological arts.

Dependent claims 11-18 depend on Claim 10 but do not add further statutory steps.

The limitations recited in claims 10-18 contain no language suggesting these claims are intended to be within the technological arts.

12.3 Method claims 19-43 are rejected for reciting a process that is not directed to the technological arts.

Regarding claim 19, this claim is directed at an equalization method, whereas none of the limitations describe any type of computer-implemented steps. To be statutory, the utility of an invention must be within the technological arts.

Dependent claims 20-43 depend on Claim 19 but do not add further statutory steps.

The limitations recited in claims 19-43 contain no language suggesting these claims are intended to be within the technological arts.

12.4 Computer readable medium claims 59-68 are rejected for not specifying in the specification what the computer readable medium is, thus allowing wide interpretation of this term including carrier wave, hard disk, floppy disk, compact disk, memory boards etc..

12.5 Data signal claims 69-75 are rejected because the data signal is not a statutory matter and therefore cannot be claimed.

13.1 Claims 1- 9 would be **statutory** if they are written as a computer implemented method for reliable symbol identification.

13.2 Claims 10- 18 would be **statutory** if they are written as a computer implemented method for reliable symbol identification.

13.3 Claims 19- 43 would be **statutory** if they are written as a computer implemented method for equalization.

13.4 Claims 59-68 would be **statutory** be specifying in the specification what the computer readable medium is and what it stores; the computer readable medium should not include carrier wave.

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

15. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

16. Claims 1-3, 6-7 and 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Hassan** (U.S. Patent 6,581,179) in view of **Dent** (U.S. Patent 6,556,634).

16.1 **Hassan** teaches methods for generating side information in the presence of time-selective fading. Specifically, as per claim 1, **Hassan** teaches a reliable symbol identification method (Abstract, L1-8; CL2, L44-59); comprising:

decoding the detected data samples to obtain data symbols (CL3, L23-25);

calculating a reliability factor of a candidate sample from values of a plurality of estimated symbols in proximity to an estimated symbol that corresponds to the candidate sample (Abstract, L1-8; CL2, L44-59);

if the reliability factor is less than a predetermined limit, designating the candidate sample as a reliable symbol (CL2, L27-36; CL3, L45-54).

Hassan does not expressly teach estimating decoded symbols from a sequence of captured samples. **Dent** teaches estimating decoded symbols from a sequence of captured samples (Fig. 6; CL3, L2-24; CL17, L54 to CL18, L50), because the multi-path signals when added together increase the signal strength, thus raising the quality of received signal (CL1, L31-34); processing the gain of combined multi-path signals suppresses interference between multiple paths (CL1, L43-44); and the accumulation method compensates for the intersymbol interference (CL4, L10-11). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Hassan** with the method of **Dent** that included estimating decoded symbols from a sequence of captured samples. The artisan would have been motivated because the multi-path signals when added together would increase the signal strength, thus raising the quality of received signal; processing the gain of combined multi-path signals would suppress interference between multiple paths; and the accumulation method would compensate for the intersymbol interference.

16.2 As per claims 2-3, **Hassan** and **Dent** teach the method of claim 1. **Hassan** does not expressly teach that the reliability factor R of the candidate sample is given by:

$R(x_n) = \sum_{i=-k1, i \neq 0}^{k2} | d\^{}_{n-i} | c_i$, where

$d\^{}_{n-i}$ is an estimated symbol,

K_1, K_2 are number of decoded symbols adjacent to the candidate sample, and

c_i is a coefficient; wherein $K_1 = 0$. **Dent** teaches that the reliability factor R of the candidate sample is given by:

$R(x_n) = \sum_{i=-k1, i\neq 0}^{k2} | d\^{}_{n-i} | c_i$, where

$d\^{}_{n-i}$ is an estimated symbol,

K_1, K_2 are number of decoded symbols adjacent to the candidate sample, and

c_i is a coefficient; wherein $K_1 = 0$ (CL1, L31-44; CL3, L4-9; CL4, L56-63; CL17, L54 to CL18, L50), because the multi-path signals when added together increase the signal strength, thus raising the quality of received signal (CL1, L31-34); processing the gain of combined multi-path signals suppresses interference between multiple paths (CL1, L43-44); and the accumulation method compensates for the intersymbol interference (CL4, L10-11). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Hassan** with the method of **Dent** that included the reliability factor R of the candidate sample being given by:

$R(x_n) = \sum_{i=-k1, i\neq 0}^{k2} | d\^{}_{n-i} | c_i$, where

$d\^{}_{n-i}$ was an estimated symbol,

K_1, K_2 were number of decoded symbols adjacent to the candidate sample, and

c_i was a coefficient; wherein $K_1 = 0$. The artisan would have been motivated because the multi-path signals when added together would increase the signal strength, thus raising the quality of received signal; processing the gain of combined multi-path signals would suppress interference between multiple paths; and the accumulation method would compensate for the intersymbol interference.

16.3 As per Claim 6, **Hassan** and **Dent** teach the method of claim 1. **Hassan** does not expressly teach that the estimating comprises generating estimated symbols according to a maximum likelihood analysis of conditional probabilities of a captured sample conditioned upon all possible sets of surrounding transmitted symbols for all possible values of the captured sample. **Dent** teaches that the estimating comprises generating estimated symbols according to a maximum likelihood analysis of conditional probabilities of a captured sample conditioned upon all possible sets of surrounding transmitted symbols for all possible values of the captured sample (CL3, L2-24; CL3, L62-64; CL4, L54-56; CL5, L44-56; CL17, L54 to CL18, L50), because the maximum likelihood method uses a set of correlations corresponding to known pilot symbols and combines each new data symbol hypothesis with a corresponding set of correlations and previous states to obtain an expanded number of states; each of the expanded number of states corresponds to hypothesized sequences extended by one more unknown data symbol and each has a likelihood indication (CL5, L46-56). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Hassan** with the method of **Dent** that included the estimating comprising generating estimated symbols according to a maximum likelihood analysis of conditional probabilities of a captured sample conditioned upon all possible sets of surrounding transmitted symbols for all possible values of the captured sample. The artisan would have been motivated because the maximum likelihood method would use a set of correlations corresponding to known pilot symbols and combine each new data symbol hypothesis with a corresponding set of correlations and previous states to obtain an expanded number of states; each of the expanded number of states would correspond to

hypothesized sequences extended by one more unknown data symbol and each would have a likelihood indication.

Hassan does not expressly teach that the estimating comprises generating estimated symbols according to the ranges of all possible ISI coefficients, for all possible values of the captured sample. **Dent** teaches that the estimating comprises generating estimated symbols according to the ranges of all possible ISI coefficients, for all possible values of the captured sample (CL17, L54 to CL18, L58), because that would compensate for inter-symbol interference, when the complex correlation for one symbol period is affected by the symbol value in at least one adjacent symbol period (CL4, L9-13). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Hassan** with the method of **Dent** that included the estimating comprising generating estimated symbols according to the ranges of all possible ISI coefficients, for all possible values of the captured sample. The artisan would have been motivated because that would compensate for inter-symbol interference, when the complex correlation for one symbol period was affected by the symbol value in at least one adjacent symbol period.

16.4 As per Claim 7, **Hassan** and **Dent** teach the method of claim 1. **Hassan** does not expressly teach that the estimation comprises generating estimated symbols according to trellis decoding based upon all possible sets of surrounding transmitted symbols for all possible values of the captured sample. **Dent** teaches that the estimation comprises generating estimated symbols according to trellis decoding based upon all possible sets of surrounding transmitted symbols for all possible values of the captured sample (CL15, L1-16; CL16, L53-59; CL17, L7-

10), because the trellis decoder combines demodulation and decoding (CL7, L7-10); and allows soft decisions to be made allowing further processing by an error correction decoder (CL15, L1-6). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Hassan** with the method of **Dent** that included the estimation comprising generating estimated symbols according to trellis decoding based upon all possible sets of surrounding transmitted symbols for all possible values of the captured sample. The artisan would have been motivated because the trellis decoder would combine demodulation and decoding; and would allow soft decisions to be made allowing further processing by an error correction decoder.

Hassan does not expressly teach that the estimation comprises generating estimated symbols according to the ranges of all possible ISI coefficients, for all possible values of the captured sample. **Dent** teaches that the estimation comprises generating estimated symbols according to the ranges of all possible ISI coefficients, for all possible values of the captured sample (CL17, L54 to CL18, L58), because that would compensate for inter-symbol interference, when the complex correlation for one symbol period is affected by the symbol value in at least one adjacent symbol period (CL4, L9-13). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Hassan** with the method of **Dent** that included the estimation comprising generating estimated symbols according to the ranges of all possible ISI coefficients, for all possible values of the captured sample. The artisan would have been motivated because that would compensate for inter-symbol interference, when the complex correlation for one symbol period is affected by the symbol value in at least one adjacent symbol period.

16.5 As per Claim 9, **Hassan** and **Dent** teach the method of claim 1. **Hassan** does not expressly teach that the estimation comprises generating estimated symbols according to a maximum likelihood analysis of conditional probabilities of a captured sample conditioned upon past symbol decisions for all possible values of the captured sample. **Dent** teaches that the estimation comprises generating estimated symbols according to a maximum likelihood analysis of conditional probabilities of a captured sample conditioned upon past symbol decisions for all possible values of the captured sample (CL3, L2-24; CL3, L62-64; CL4, L54-56; CL5, L44-56; CL17, L54 to CL18, L50), because the maximum likelihood method uses a set of correlations corresponding to known pilot symbols and combines each new data symbol hypothesis with a corresponding set of correlations and previous states to obtain an expanded number of states; each of the expanded number of states corresponds to hypothesized sequences extended by one more unknown data symbol and each has a likelihood indication (CL5, L46-56). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Hassan** with the method of **Dent** that included the estimation comprising generating estimated symbols according to a maximum likelihood analysis of conditional probabilities of a captured sample conditioned upon past symbol decisions for all possible values of the captured sample. The artisan would have been motivated because the maximum likelihood method would use a set of correlations corresponding to known pilot symbols and combine each new data symbol hypothesis with a corresponding set of correlations and previous states to obtain an expanded number of states; each of the expanded number of states would correspond to

hypothesized sequences extended by one more unknown data symbol and each would have a likelihood indication.

Hassan does not expressly teach that the estimating comprises generating estimated symbols according to the ranges of all possible ISI coefficients, for all possible values of the captured sample. **Dent** teaches that the estimating comprises generating estimated symbols according to the ranges of all possible ISI coefficients, for all possible values of the captured sample (CL17, L54 to CL18, L58), because that would compensate for inter-symbol interference, when the complex correlation for one symbol period is affected by the symbol value in at least one adjacent symbol period (CL4, L9-13). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Hassan** with the method of **Dent** that included the estimating comprising generating estimated symbols according to the ranges of all possible ISI coefficients, for all possible values of the captured sample. The artisan would have been motivated because that would compensate for inter-symbol interference, when the complex correlation for one symbol period was affected by the symbol value in at least one adjacent symbol period.

16.6 As per claim 10, **Hassan** teaches a reliable symbol identification method (Abstract, L1-8; CL2, L44-59); comprising:

decoding the detected data samples to obtain data symbols (CL3, L23-25);

calculating a reliability factor of a candidate sample from values of a plurality of decoded symbols in proximity to the candidate sample (Abstract, L1-8; CL2, L44-59);

if the reliability factor is less than a predetermined limit, designating the candidate sample as a reliable symbol (CL2, L27-36; CL3, L45-54).

Hassan does not expressly teach obtaining decoded symbols from a sequence of captured samples. **Dent** teaches obtaining decoded symbols from a sequence of captured samples (Fig. 6; CL3, L2-24; CL17, L54 to CL18, L50), because the multi-path signals when added together increase the signal strength, thus raising the quality of received signal (CL1, L31-34); processing the gain of combined multi-path signals suppresses interference between multiple paths (CL1, L43-44); and the accumulation method compensates for the intersymbol interference (CL4, L10-11). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Hassan** with the method of **Dent** that included obtaining decoded symbols from a sequence of captured samples. The artisan would have been motivated because the multi-path signals when added together would increase the signal strength, thus raising the quality of received signal; processing the gain of combined multi-path signals would suppress interference between multiple paths; and the accumulation method would compensate for the intersymbol interference.

16.7 As per claim 11, **Hassan** and **Dent** teach the method of claim 1. **Hassan** does not expressly teach that the reliability factor R of the candidate sample is given by:

$R(x_n) = \sum_{i=-k1, i \neq 0}^{k2} | \hat{d}_{n-i} | c_i$, where

$\hat{d}_{n-i}$ is a decoded symbol,

K_1, K_2 are number of decoded symbols adjacent to the candidate sample, and

c_i is a coefficient. **Dent** teaches that the reliability factor R of the candidate sample is given by:

$R(x_n) = \sum_{i=-k1, i\neq 0}^{k2} | d^\wedge_{n-i} | c_i$, where

$d^\wedge_{n-i}$ is a decoded symbol,

K_1, K_2 are number of decoded symbols adjacent to the candidate sample, and

c_i is a coefficient. (CL1, L31-44; CL3, L4-9; CL4, L56-63; CL17, L54 to CL18, L50), because the multi-path signals when added together increase the signal strength, thus raising the quality of received signal (CL1, L31-34); processing the gain of combined multi-path signals suppresses interference between multiple paths (CL1, L43-44); and the accumulation method compensates for the intersymbol interference (CL4, L10-11). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Hassan** with the method of **Dent** that included the reliability factor R of the candidate sample being given by:

$R(x_n) = \sum_{i=-k1, i\neq 0}^{k2} | d^\wedge_{n-i} | c_i$, where

$d^\wedge_{n-i}$ was a decoded symbol,

K_1, K_2 were number of decoded symbols adjacent to the candidate sample, and

c_i was a coefficient. The artisan would have been motivated because the multi-path signals when added together would increase the signal strength, thus raising the quality of received signal; processing the gain of combined multi-path signals would suppress interference between multiple paths; and the accumulation method would compensate for the intersymbol interference.

17. Claims 19, 21, 24, 29, 39-40, 44-46, 48-49, 59, 61, 63, 68-69 and 71 rejected under 35 U.S.C. 103(a) as being unpatentable over **Rakib et al.** (U.S. Patent 6,665,308) in view of **Sakoda** (U.S. Patent 6,456,669).

17.1 As per claim 19, **Rakib et al.** teaches an equalization method (CL90, L43-44; CL90, L54 to CL91, L13), comprising:

estimating decoded symbols from captured samples based on a set of ISI coefficient estimates (CL90, L54 to CL91, L13), and

revising the ISI coefficients based on the decoded symbols and corresponding received sample values (CL91, L28-31).

Rakib et al. teaches that the contribution of each symbol-sample pair is weighted (CL91, L4-8). **Rakib et al.** does not expressly teach that the contribution of each symbol-sample pair is weighted according to reliability factor of the respective captured sample. **Sakoda** teaches that the contribution of each symbol-sample pair is weighted according to reliability factor of the respective captured sample (CL11, L62 to CL12, L8; CL12, L25-35), because that reflects the data block reliability in the signal level of the received symbol (CL12, L1-2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Rakib et al.** with the method of **Sakoda** that included the contribution of each symbol-sample pair being weighted according to reliability factor of the respective captured sample. The artisan would have been motivated because that would reflect the data block reliability in the signal level of the received symbol.

17.2 As per claim 21, **Rakib et al.** and **Sakoda** teach the equalization method of claim 19. **Rakib et al.** does not expressly teach that the weighting of a symbol-sample pair is proportional to the reliability factor of the candidate sample.. **Sakoda** teaches that the weighting of a

symbol-sample pair is proportional to the reliability factor of the candidate sample (CL11, L62 to CL12, L8; CL12, L25-35), because that reflects the data block reliability in the signal level of the received symbol (CL12, L1-2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Rakib et al.** with the method of **Sakoda** that included the weighting of a symbol-sample pair being proportional to the reliability factor of the candidate sample. The artisan would have been motivated because that would reflect the data block reliability in the signal level of the received symbol.

17.3 As per claim 24, **Rakib et al.** and **Sakoda** teach the equalization method of claim 19. **Rakib et al.** does not expressly teach that the reliability factor of a candidate sample x_n is determined from values of neighboring samples. **Sakoda** teaches that the reliability factor of a candidate sample x_n is determined from values of neighboring samples (CL11, L62 to CL12, L8; CL12, L25-35), because that reflects the data block reliability in the signal level of the received symbol (CL12, L1-2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Rakib et al.** with the method of **Sakoda** that included the reliability factor of a candidate sample x_n being determined from values of neighboring samples. The artisan would have been motivated because that would reflect the data block reliability in the signal level of the received symbol.

17.4 As per claim 29, **Rakib et al.** and **Sakoda** teach the equalization method of claim 19. **Rakib et al.** does not expressly teach that the reliability factor of a candidate sample x_n is determined from values of estimated symbols $d^\wedge_{n-i}$ neighboring the candidate sample. **Sakoda**

teaches that the reliability factor of a candidate sample x_n is determined from values of estimated symbols $d\^{}_{n-i}$ neighboring the candidate sample (CL11, L62 to CL12, L8; CL12, L25-35), because that reflects the data block reliability in the signal level of the received symbol (CL12, L1-2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Rakib et al.** with the method of **Sakoda** that included the reliability factor of a candidate sample x_n being determined from values of estimated symbols $d\^{}_{n-i}$ neighboring the candidate sample. The artisan would have been motivated because that would reflect the data block reliability in the signal level of the received symbol.

17.5 As per claim 39, **Rakib et al.** and **Sakoda** teach the equalization method of claim 19. **Rakib et al.** teaches that the estimating and the revising operate on captured samples and estimated symbols on a frame-by-frame basis (CL7, L35-37; CL7, L14-15; Fig. 2A; CL9, L41-43; CL90, L54 to CL91, L13; CL62, L33-35; CL62, L47-50).

17.6 As per claim 40, **Rakib et al.** and **Sakoda** teach the equalization method of claim 39. **Rakib et al.** teaches that the frames each contain a uniform number of captured samples and estimated symbols (CL7, L35-37; CL7, L14-15; Fig. 2A; CL9, L41-43; CL62, L33-35).

17.7 As per claim 44, **Rakib et al.** teaches an equalizer (CL90, L43-44; CL90, L54 to CL91, L13), comprising:

a symbol decoder having a first input for captured samples, a second input for estimated ISI coefficients and an output for estimated symbols (CL90, L54 to CL91, L13), and

an ISI estimator having a first input coupled to the symbol decoder output, a second input coupled to the first input of the symbol decoder and an output for the estimated ISI coefficients, wherein the ISI estimator estimates ISI coefficients based on the decoded symbols and corresponding received sample values (CL91, L28-31).

Rakib et al. teaches each symbol-sample pair being weighted (CL91, L4-8). **Rakib et al.** does not expressly teach each symbol-sample pair being weighted according to reliability factor of the respective captured sample. **Sakoda** teaches each symbol-sample pair being weighted according to reliability factor of the respective captured sample (CL11, L62 to CL12, L8; CL12, L25-35), because that reflects the data block reliability in the signal level of the received symbol (CL12, L1-2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the equalizer of **Rakib et al.** with the equalizer of **Sakoda** that included each symbol-sample pair being weighted according to reliability factor of the respective captured sample. The artisan would have been motivated because that would reflect the data block reliability in the signal level of the received symbol.

17.8 As per claim 45, **Rakib et al.** and **Sakoda** teach the equalizer of claim 44. **Rakib et al.** teaches that the symbol decoder comprises a subtractive equalizer coupled to a decision unit (CL90, L43-44; CL90, L60 to CL91, L13).

17.9 As per claim 46, **Rakib et al.** and **Sakoda** teach the equalizer of claim 44. **Rakib et al.** does not expressly teach that the symbol decoder comprises a maximum likelihood estimator coupled to a decision unit. **Sakoda** teaches that the symbol decoder comprises a maximum

likelihood estimator coupled to a decision unit (CL3, L34-41; CL12, L26-29), because when the communication quality differs from data block to data block, the decoding circuit with maximum likelihood estimation would perform estimation more accurately and be able to restore the data bit series more accurately using reliability information than other estimators (CL12, L40-44). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the equalizer of **Rakib et al.** with the equalizer of **Sakoda** that included the symbol decoder comprising a maximum likelihood estimator coupled to a decision unit. The artisan would have been motivated because when the communication quality differed from data block to data block, the decoding circuit with maximum likelihood estimation would perform estimation more accurately and be able to restore the data bit series more accurately using reliability information than other estimators.

17.10 As per claim 48, **Rakib et al.** and **Sakoda** teach the equalizer of claim 46. **Rakib et al.** teaches assigning previously decoded symbols to occur with probability equal to one (CL91, L10-13). **Rakib et al.** does not expressly teach that the maximum likelihood analysis is made having assigned previously decoded symbols to occur with probability equal to one. **Sakoda** teaches that the maximum likelihood analysis is made (CL3, L34-41; CL12, L26-29), because when the communication quality differs from data block to data block, the decoding circuit with maximum likelihood estimation would perform estimation more accurately and be able to restore the data bit series more accurately using reliability information than other estimators (CL12, L40-44). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the equalizer of **Rakib et al.** that included assigning previously decoded

symbols to occur with probability equal to one with the equalizer of **Sakoda** that included the maximum likelihood analysis being made. The artisan would have been motivated because when the communication quality differed from data block to data block, the decoding circuit with maximum likelihood estimation would perform estimation more accurately and be able to restore the data bit series more accurately using reliability information than other estimators.

17.11 As per claim 49, **Rakib et al.** and **Sakoda** teach the equalizer of claim 44. **Rakib et al.** teaches that the symbol decoder comprises a trellis decoder coupled to a decision unit (CL46, L37-49).

17.12 As per claim 59, **Rakib et al.** teaches a computer readable medium having instructions stored thereon that, when executed by processing unit, causes the following method to be executed (Fig. 28, Item 405):

estimating decoded symbols from a sequence of captured samples and a set of estimated ISI coefficients (CL90, L54 to CL91, L13), and

revising the ISI coefficients based on the decoded symbols and corresponding received sample values (CL91, L28-31).

Rakib et al. teaches that the contribution of each symbol-sample pair to the revision is weighted (CL91, L4-8). **Rakib et al.** does not expressly teach that the contribution of each symbol-sample pair to the revision is weighted according to reliability factor of the respective captured sample. **Sakoda** teaches that the contribution of each symbol-sample pair to the revision is weighted according to reliability factor of the respective captured sample (CL11, L62

to CL12, L8; CL12, L25-35), because that reflects the data block reliability in the signal level of the received symbol (CL12, L1-2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the medium of **Rakib et al.** with the medium of **Sakoda** that included the contribution of each symbol-sample pair to the revision being weighted according to reliability factor of the respective captured sample. The artisan would have been motivated because that would reflect the data block reliability in the signal level of the received symbol.

17.13 As per claim 61, **Rakib et al.** and **Sakoda** teach the medium of claim 59. **Rakib et al.** does not expressly teach that the weighting of a symbol-sample pair is proportional to the reliability factor of the candidate sample. **Sakoda** teaches that the weighting of a symbol-sample pair is proportional to the reliability factor of the candidate sample (CL11, L62 to CL12, L8; CL12, L25-35), because that reflects the data block reliability in the signal level of the received symbol (CL12, L1-2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the medium of **Rakib et al.** with the medium of **Sakoda** that included the weighting of a symbol-sample pair being proportional to the reliability factor of the candidate sample. The artisan would have been motivated because that would reflect the data block reliability in the signal level of the received symbol.

17.14 As per claim 63, **Rakib et al.** and **Sakoda** teach the medium of claim 59. **Rakib et al.** does not expressly teach that the reliability factor of a candidate sample is determined from values of samples neighboring the candidate sample. **Sakoda** teaches that the reliability factor of

a candidate sample is determined from values of samples neighboring the candidate sample (CL11, L62 to CL12, L8; CL12, L25-35), because that reflects the data block reliability in the signal level of the received symbol (CL12, L1-2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the medium of **Rakib et al.** with the medium of **Sakoda** that included the reliability factor of a candidate sample being determined from values of samples neighboring the candidate sample. The artisan would have been motivated because that would reflect the data block reliability in the signal level of the received symbol.

17.15 As per claim 68, **Rakib et al.** and **Sakoda** teach the medium of claim 59. **Rakib et al.** teaches that the estimating and the revising operate on frames of captured samples and estimated symbols on a frame-by-frame basis (CL7, L35-37; CL7, L14-15; Fig. 2A; CL9, L41-43; CL90, L54 to CL91, L13; CL62, L33-35; CL62, L47-50).

17.16 As per claim 69, **Rakib et al.** teaches data signal, comprising a sequence of decoded symbols (Fig. 26, Item 468, output; CL15, L15-18), created according to a method comprising:

estimating decoded symbols from a sequence of captured samples based on a set of estimated ISI coefficients (CL90, L54 to CL91, L13), and

contemporaneously revising the estimated ISI coefficients based on a comparison of the estimated symbols and the decoded symbols (CL91, L28-31), and

outputting a sequence of the decoded symbols (Fig. 26, Item 468, output; CL15, L15-18).

Rakib et al. teaches that the contribution of each symbol-sample pair to the revision is weighted (CL91, L4-8). **Rakib et al.** does not expressly teach that the contribution of each symbol-sample pair to the revision is weighted according to reliability factor of the respective captured sample. **Sakoda** teaches that the contribution of each symbol-sample pair to the revision is weighted according to reliability factor of the respective captured sample (CL11, L62 to CL12, L8; CL12, L25-35), because that reflects the data block reliability in the signal level of the received symbol (CL12, L1-2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the data signal of **Rakib et al.** with the data signal of **Sakoda** that included the contribution of each symbol-sample pair to the revision being weighted according to reliability factor of the respective captured sample. The artisan would have been motivated because that would reflect the data block reliability in the signal level of the received symbol.

17.17 As per claim 71, **Rakib et al.** and **Sakoda** teach data signal of claim 69. **Rakib et al.** does not expressly teach that a symbol-sample pair is weighted in a manner proportional to the reliability factor of the candidate sample. **Sakoda** teaches that a symbol-sample pair is weighted in a manner proportional to the reliability factor of the candidate sample (CL11, L62 to CL12, L8; CL12, L25-35), because that reflects the data block reliability in the signal level of the received symbol (CL12, L1-2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the data signal of **Rakib et al.** with the data signal of **Sakoda** that included a symbol-sample pair being weighted in a manner proportional to the

reliability factor of the candidate sample. The artisan would have been motivated because that would reflect the data block reliability in the signal level of the received symbol.

18. Claims 20, 22, 23, 60, 62, 70 and 72 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Rakib et al.** (U.S. Patent 6,665,308) in view of **Sakoda** (U.S. Patent 6,456,669), and further in view of **Komatsu** (U.S. Patent 6,560,272).

18.1 As per claim 20, **Rakib et al.** and **Sakoda** teach the equalization method of claim 19. **Rakib et al.** does not expressly teach that the weighting of a symbol-sample pair comprises: comparing the reliability factor of a candidate sample to a threshold, and assigning a first weight value to the symbol-sample pair if the reliability factor exceeds the threshold, and otherwise, assigning a second weight value to the symbol-sample pair. **Komatsu** teaches that the weighting of a symbol-sample pair comprises: comparing the reliability factor of a candidate sample to a threshold (CL4, L51-52); and assigning a first weight value to the symbol-sample pair if the reliability factor exceeds the threshold, and otherwise, assigning a second weight value to the symbol-sample pair (CL4, L54-61), because the interpolation method is decided based on the reliability and the compensation vectors for compensating the phase are generated by the decided interpolation method (CL3, L6-9). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Rakib et al.** with the method of **Komatsu** that included the weighting of a symbol-sample pair comprising: comparing the reliability factor of a candidate sample to a threshold, and assigning a first weight value to the symbol-sample pair if the reliability factor exceeded the threshold, and otherwise, assigning a

second weight value to the symbol-sample pair. The artisan would have been motivated because the interpolation method would be decided based on the reliability and the compensation vectors for compensating the phase would be generated by the decided interpolation method.

18.2 As per claim 22, **Rakib et al.** and **Sakoda** teach the equalization method of claim 19. **Rakib et al.** does not expressly teach that the weighting of a candidate sample comprises: comparing the reliability factor of a candidate sample to a threshold, and assigning a first weight value to the symbol-sample pair if the reliability factor exceeds the threshold, and otherwise, assigning a second weight value to the symbol-sample pair. **Komatsu** teaches that the weighting of a candidate sample comprises: comparing the reliability factor of a candidate sample to a threshold (CL4, L51-52); and assigning a first weight value to the symbol-sample pair if the reliability factor exceeds the threshold, and otherwise, assigning a second weight value to the symbol-sample pair (CL4, L54-61), because the interpolation method is decided based on the reliability and the compensation vectors for compensating the phase are generated by the decided interpolation method (CL3, L6-9). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Rakib et al.** with the method of **Komatsu** that included the weighting of a candidate sample comprising: comparing the reliability factor of a candidate sample to a threshold, and assigning a first weight value to the symbol-sample pair if the reliability factor exceeded the threshold, and otherwise, assigning a second weight value to the symbol-sample pair. The artisan would have been motivated because the interpolation method would be decided based on the reliability and the compensation vectors for compensating the phase would be generated by the decided interpolation method.

Rakib et al. does not expressly teach that the second weight being is proportional to the reliability factor of the candidate sample. **Sakoda** teaches that the second weight being is proportional to the reliability factor of the candidate sample (CL11, L62 to CL12, L8; CL12, L25-35), because that reflects the data block reliability in the signal level of the received symbol (CL12, L1-2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Rakib et al.** with the method of **Sakoda** that included the second weight being was proportional to the reliability factor of the candidate sample. The artisan would have been motivated because that would reflect the data block reliability in the signal level of the received symbol.

18.3 As per claim 23, **Rakib et al.** and **Sakoda** teach the equalization method of claim 19. **Rakib et al.** does not expressly teach that the weighting of a candidate sample comprises: comparing the reliability factor of a candidate sample to a threshold, and assigning a first weight value to the symbol-sample pair if the reliability factor is less than the threshold, and otherwise, assigning a second weight value to the symbol-sample pair. **Komatsu** teaches that the weighting of a candidate sample comprises: comparing the reliability factor of a candidate sample to a threshold (CL4, L51-52); and assigning a first weight value to the symbol-sample pair if the reliability factor is less than the threshold, and otherwise, assigning a second weight value to the symbol-sample pair (CL4, L54-61), because the interpolation method is decided based on the reliability and the compensation vectors for compensating the phase are generated by the decided interpolation method (CL3, L6-9). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Rakib et al.** with the method of

Komatsu that included the weighting of a candidate sample comprising: comparing the reliability factor of a candidate sample to a threshold, and assigning a first weight value to the symbol-sample pair if the reliability factor was less than the threshold, and otherwise, assigning a second weight value to the symbol-sample pair. The artisan would have been motivated because the interpolation method would be decided based on the reliability and the compensation vectors for compensating the phase would be generated by the decided interpolation method.

Rakib et al. does not expressly teach that the second weight being is proportional to the reliability factor of the candidate sample. **Sakoda** teaches that the second weight being is proportional to the reliability factor of the candidate sample (CL11, L62 to CL12, L8; CL12, L25-35), because that reflects the data block reliability in the signal level of the received symbol (CL12, L1-2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Rakib et al.** with the method of **Sakoda** that included the second weight being was proportional to the reliability factor of the candidate sample. The artisan would have been motivated because that would reflect the data block reliability in the signal level of the received symbol.

18.4 As per claim 60, **Rakib et al.** and **Sakoda** teach the medium of claim 59. **Rakib et al.** does not expressly teach that the weighting of a symbol-sample pair comprises: comparing the reliability factor of a candidate sample to a threshold, and assigning a first weight value to the symbol-sample pair if the reliability factor exceeds the threshold, and otherwise, assigning a second weight value to the symbol-sample pair. **Komatsu** teaches that the weighting of a symbol-sample pair comprises: comparing the reliability factor of a candidate sample to a

threshold (CL4, L51-52); and assigning a first weight value to the symbol-sample pair if the reliability factor exceeds the threshold, and otherwise, assigning a second weight value to the symbol-sample pair (CL4, L54-61), because the interpolation method is decided based on the reliability and the compensation vectors for compensating the phase are generated by the decided interpolation method (CL3, L6-9). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the medium of **Rakib et al.** with the medium of **Komatsu** that included the weighting of a symbol-sample pair comprising: comparing the reliability factor of a candidate sample to a threshold, and assigning a first weight value to the symbol-sample pair if the reliability factor exceeded the threshold, and otherwise, assigning a second weight value to the symbol-sample pair. The artisan would have been motivated because the interpolation method would be decided based on the reliability and the compensation vectors for compensating the phase would be generated by the decided interpolation method.

18.5 As per claim 62, **Rakib et al.** and **Sakoda** teach the medium of claim 59. **Rakib et al.** does not expressly teach that the weighting of a candidate sample comprises: comparing the reliability factor of a candidate sample to a threshold, and assigning a first weight value to the symbol-sample pair if the reliability factor exceeds the threshold, and otherwise, assigning a second weight value to the symbol-sample pair. **Komatsu** teaches that the weighting of a candidate sample comprises: comparing the reliability factor of a candidate sample to a threshold (CL4, L51-52); and assigning a first weight value to the symbol-sample pair if the reliability factor exceeds the threshold, and otherwise, assigning a second weight value to the symbol-sample pair (CL4, L54-61), because the interpolation method is decided based on the

reliability and the compensation vectors for compensating the phase are generated by the decided interpolation method (CL3, L6-9). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the medium of **Rakib et al.** with the medium of **Komatsu** that included the weighting of a candidate sample comprising: comparing the reliability factor of a candidate sample to a threshold, and assigning a first weight value to the symbol-sample pair if the reliability factor exceeded the threshold, and otherwise, assigning a second weight value to the symbol-sample pair. The artisan would have been motivated because the interpolation method would be decided based on the reliability and the compensation vectors for compensating the phase would be generated by the decided interpolation method.

Rakib et al. does not expressly teach that the second weight being is proportional to the reliability factor of the candidate sample. **Sakoda** teaches that the second weight being is proportional to the reliability factor of the candidate sample (CL11, L62 to CL12, L8; CL12, L25-35), because that reflects the data block reliability in the signal level of the received symbol (CL12, L1-2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the medium of **Rakib et al.** with the medium of **Sakoda** that included the second weight being was proportional to the reliability factor of the candidate sample. The artisan would have been motivated because that would reflect the data block reliability in the signal level of the received symbol.

18.6 As per claim 70, **Rakib et al.** and **Sakoda** teach data signal of claim 69. **Rakib et al.** does not expressly teach that a symbol-sample pair is weighted according to: comparing the reliability factor of a candidate sample to a threshold, and assigning a first weight value to the

symbol-sample pair if the reliability factor exceeds the threshold, and otherwise, assigning a second weight value to the symbol-sample pair. **Komatsu** teaches that a symbol-sample pair is weighted according to: comparing the reliability factor of a candidate sample to a threshold (CL4, L51-52); and assigning a first weight value to the symbol-sample pair if the reliability factor exceeds the threshold, and otherwise, assigning a second weight value to the symbol-sample pair (CL4, L54-61), because the interpolation method is decided based on the reliability and the compensation vectors for compensating the phase are generated by the decided interpolation method (CL3, L6-9). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the data signal of **Rakib et al.** with the data signal of **Komatsu** that included a symbol-sample pair being weighted according to: comparing the reliability factor of a candidate sample to a threshold, and assigning a first weight value to the symbol-sample pair if the reliability factor exceeded the threshold, and otherwise, assigning a second weight value to the symbol-sample pair. The artisan would have been motivated because the interpolation method would be decided based on the reliability and the compensation vectors for compensating the phase would be generated by the decided interpolation method.

18.7 As per claim 72, **Rakib et al.** and **Sakoda** teach data signal of claim 69. **Rakib et al.** does not expressly teach that a symbol-sample pair is weighted according to: comparing the reliability factor of a candidate sample to a threshold, and assigning a first weight value to the symbol-sample pair if the reliability factor exceeds the threshold, and otherwise, assigning a second weight value to the symbol-sample pair. **Komatsu** teaches that a symbol-sample pair is weighted according to: comparing the reliability factor of a candidate sample to a threshold

(CL4, L51-52); and assigning a first weight value to the symbol-sample pair if the reliability factor exceeds the threshold, and otherwise, assigning a second weight value to the symbol-sample pair (CL4, L54-61), because the interpolation method is decided based on the reliability and the compensation vectors for compensating the phase are generated by the decided interpolation method (CL3, L6-9). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the data signal of **Rakib et al.** with the data signal of **Komatsu** that included a symbol-sample pair being weighted according to: comparing the reliability factor of a candidate sample to a threshold, and assigning a first weight value to the symbol-sample pair if the reliability factor exceeded the threshold, and otherwise, assigning a second weight value to the symbol-sample pair. The artisan would have been motivated because the interpolation method would be decided based on the reliability and the compensation vectors for compensating the phase would be generated by the decided interpolation method.

Rakib et al. does not expressly teach that the second weight being is proportional to the reliability factor of the candidate sample. **Sakoda** teaches that the second weight being is proportional to the reliability factor of the candidate sample (CL11, L62 to CL12, L8; CL12, L25-35), because that reflects the data block reliability in the signal level of the received symbol (CL12, L1-2). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the medium of **Rakib et al.** with the medium of **Sakoda** that included the second weight being was proportional to the reliability factor of the candidate sample. The artisan would have been motivated because that would reflect the data block reliability in the signal level of the received symbol.

19. Claims 25, 26, 30 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Rakib et al.** (U.S. Patent 6,665,308) in view of **Sakoda** (U.S. Patent 6,456,669), and further in view of **Dent** (U.S. Patent 6,556,634).

19.1 As per claim 25, **Rakib et al.** and **Sakoda** teach the equalization method of claim 24. **Rakib et al.** does not expressly teach that the reliability factor R of the candidate sample x_n is given by:

$$R(x_n) = \sum_{i=-k1, i \neq 0}^{k2} | x_{n-i} | c_i \text{, where}$$

x_{n-i} is a value of a surrounding sample,

K_1, K_2 are numbers of samples adjacent to sample x_n, and

c_i is a coefficient. **Dent** teaches that the reliability factor R of the candidate sample x_n is given by:

$$R(x_n) = \sum_{i=-k1, i \neq 0}^{k2} | x_{n-i} | c_i \text{, where}$$

x_{n-i} is a value of a surrounding sample,

K_1, K_2 are numbers of samples adjacent to sample x_n, and

c_i is a coefficient (CL1, L31-44; CL3, L4-9; CL4, L56-63; CL17, L54 to CL18, L50), because the multi-path signals when added together increase the signal strength, thus raising the quality of received signal (CL1, L31-34); processing the gain of combined multi-path signals suppresses interference between multiple paths (CL1, L43-44); and the accumulation method compensates for the intersymbol interference (CL4, L10-11). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Rakib et**

al. with the method of **Dent** that included the reliability factor R of the candidate sample x_n being given by:

$$R(x_n) = \sum_{i=-k1, i \neq 0}^{k2} | x_{n-i} | c_i \text{, where}$$

x_{n-i} was a value of a surrounding sample,

K_1, K_2 were numbers of samples adjacent to sample x_n, and

c_i was a coefficient. The artisan would have been motivated because the multi-path signals when added together would increase the signal strength, thus raising the quality of received signal; processing the gain of combined multi-path signals would suppress interference between multiple paths; and the accumulation method would compensate for the intersymbol interference.

19.2 As per claim 26, **Rakib et al.** and **Sakoda** teach the equalization method of claim 24. **Rakib et al.** does not expressly teach that the reliability factor R of the candidate sample x_n is given by:

$$R(x_n) = \sum_{i=1}^{k} | x_{n-i} | c_i \text{, where}$$

x_{n-i} is a sample in the neighborhood of the candidate sample,

K represents a number of samples adjacent to the candidate sample x_n, and

c_i is a coefficient. **Dent** teaches that the reliability factor R of the candidate sample x_n is given by:

$$R(x_n) = \sum_{i=1}^{k} | x_{n-i} | c_i \text{, where}$$

x_{n-i} is a sample in the neighborhood of the candidate sample,

K represents a number of samples adjacent to the candidate sample x_n, and

c_i is a coefficient (CL1, L31-44; CL3, L4-9; CL4, L56-63; CL17, L54 to CL18, L50), because the multi-path signals when added together increase the signal strength, thus raising the quality of received signal (CL1, L31-34); processing the gain of combined multi-path signals suppresses interference between multiple paths (CL1, L43-44); and the accumulation method compensates for the intersymbol interference (CL4, L10-11). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Rakib et al.** with the method of **Dent** that included the reliability factor R of the candidate sample x_n being given by:

$$R(x_n) = \sum_{i=1}^{k} |\, x_{n-i} \,|\, c_i \text{, where}$$

x_{n-i} was a sample in the neighborhood of the candidate sample,

K represented a number of samples adjacent to the candidate sample x_n, and

c_i was a coefficient. The artisan would have been motivated because the multi-path signals when added together would increase the signal strength, thus raising the quality of received signal; processing the gain of combined multi-path signals would suppress interference between multiple paths; and the accumulation method would compensate for the intersymbol interference.

19.3 As per claim 30, **Rakib et al.** and **Sakoda** teach the equalization method of claim 29. **Rakib et al.** does not expressly teach that the reliability factor R of the candidate sample x_n is given by:

$$R(x_n) = \sum_{i=-k1,\, i\neq 0}^{k2} |\, d^\wedge_{n-i} \,|\, c_i \text{, where}$$

$d^\wedge_{n-i}$ is an estimated symbol,

K_1, K_2 are number of decoded symbols adjacent to the candidate sample, and

c_i is a coefficient. **Dent** teaches that the reliability factor R of the candidate sample x_n is given by:

$$R(x_n) = \sum_{i=-k1, i \neq 0}^{k2} \left| \hat{d}_{n-i} \right| c_i \text{, where}$$

$d\hat{}_{n-i}$ is an estimated symbol,

K_1, K_2 are number of decoded symbols adjacent to the candidate sample, and

c_i is a coefficient (CL1, L31-44; CL3, L4-9; CL4, L56-63; CL17, L54 to CL18, L50), because the multi-path signals when added together increase the signal strength, thus raising the quality of received signal (CL1, L31-34); processing the gain of combined multi-path signals suppresses interference between multiple paths (CL1, L43-44); and the accumulation method compensates for the intersymbol interference (CL4, L10-11). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Rakib et al.** with the method of **Dent** that included the reliability factor R of the candidate sample x_n being given by:

$$R(x_n) = \sum_{i=-k1, i \neq 0}^{k2} \left| \hat{d}_{n-i} \right| c_i \text{, where}$$

$d\hat{}_{n-i}$ was an estimated symbol,

K_1, K_2 were number of decoded symbols adjacent to the candidate sample, and

c_i was a coefficient. The artisan would have been motivated because the multi-path signals when added together would increase the signal strength, thus raising the quality of received signal; processing the gain of combined multi-path signals would suppress interference between multiple paths; and the accumulation method would compensate for the intersymbol interference.

19.4 As per claim 31, **Rakib et al.** and **Sakoda** teach the equalization method of claim 29. **Rakib et al.** does not expressly teach that the reliability factor R of the candidate sample x_n is given by:

$$R(x_n) = \sum_{i=1}^{k} \mid d\hat{}_{n-i} \mid c_i \text{, where}$$

$d\hat{}_{n-i}$ is a value of an estimated symbol,

K represents a number of samples neighboring to the sample x_n, and

c_i is a coefficient. **Dent** teaches that the reliability factor R of the candidate sample x_n is given by:

$$R(x_n) = \sum_{i=1}^{k} \mid d\hat{}_{n-i} \mid c_i \text{, where}$$

$d\hat{}_{n-i}$ is a value of an estimated symbol,

K represents a number of samples neighboring to the sample x_n, and

c_i is a coefficient (CL1, L31-44; CL3, L4-9; CL4, L56-63; CL17, L54 to CL18, L50), because the multi-path signals when added together increase the signal strength, thus raising the quality of received signal (CL1, L31-34); processing the gain of combined multi-path signals suppresses interference between multiple paths (CL1, L43-44); and the accumulation method compensates for the intersymbol interference (CL4, L10-11). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Rakib et al.** with the method of **Dent** that included the reliability factor R of the candidate sample x_n being given by:

$$R(x_n) = \sum_{i=1}^{k} \mid d\hat{}_{n-i} \mid c_i \text{, where}$$

$d\hat{}_{n-i}$ was a value of an estimated symbol,

K represented a number of samples neighboring to the sample x_n, and

c_i was a coefficient. The artisan would have been motivated because the multi-path signals when added together would increase the signal strength, thus raising the quality of received signal; processing the gain of combined multi-path signals would suppress interference between multiple paths; and the accumulation method would compensate for the intersymbol interference.

20. Claim 43 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Rakib et al.** (U.S. Patent 6,665,308) in view of **Sakoda** (U.S. Patent 6,456,669), and further in view of **Dapper et al.** (U.S. Patent 6,275,990).

20.1 As per claim 43, **Rakib et al.** and **Sakoda** teach the equalization method of claim 39. **Rakib et al.** does not expressly teach that frame lengths vary according to a regular progression of predetermined lengths. **Dapper et al.** teaches that frame lengths vary according to a regular progression of predetermined lengths (CL32, L29-32; CL32, L35-40), because that allows for providing different amount of error protection (CL32, L27-28). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the method of **Rakib et al.** with the method of **Dapper et al.** that included frame lengths varying according to a regular progression of predetermined lengths. The artisan would have been motivated because that would allow for providing different amount of error protection.

21. Claims 51 and 64 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Rakib et al.** (U.S. Patent 6,665,308) in view of **Sakoda** (U.S. Patent 6,456,669), and further in view of **Hassan** (U.S. Patent 6,581,179).

21.1 As per claim 51, **Rakib et al.** and **Sakoda** teach the equalizer of claim 44. **Rakib et al.** teaches symbol detector having an input coupled to the first input of the symbol decoder and an output that enables the symbol decoder (CL90, L54 to CL91, L13). **Rakib et al.** does not expressly teach a reliable symbol detector having an input coupled to the first input of the symbol decoder and an output that enables the symbol decoder. **Hassan** teaches a reliable symbol detector (Abstract, L1-8; CL2, L27-36; CL2, L44-59; CL3, L45-54), because that allows significant enhancement in performance especially with respect to signal-to-noise ratio (CL2, L59-62). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the equalizer of **Rakib et al.** with the equalizer of **Hassan** that included a reliable symbol detector. The artisan would have been motivated because that would allow significant enhancement in performance especially with respect to signal-to-noise ratio.

21.2 As per claim 64, **Rakib et al.** and **Sakoda** teach the medium of claim 59. **Rakib et al.** does not expressly teach that the reliability factor of a candidate sample x_n is determined from values of estimated symbols $d\^_{n-i}$ neighboring the n^{th} estimated symbol. **Hassan** teaches that the reliability factor of a candidate sample x_n is determined from values of estimated symbols $d\^_{n-i}$ neighboring the n^{th} estimated symbol (Abstract, L1-8; CL2, L44-59), because that allows significant enhancement in performance especially with respect to signal-to-noise ratio (CL2, L59-62). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the medium of **Rakib et al.** with the medium of **Hassan** that included the reliability factor of a candidate sample x_n being determined from values of estimated symbols

$d\hat{}_{n-i}$ neighboring the n^{th} estimated symbol. The artisan would have been motivated because that would allow significant enhancement in performance especially with respect to signal-to-noise ratio.

22. Claims 52, 53 and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Rakib et al.** (U.S. Patent 6,665,308) in view of **Hassan** (U.S. Patent 6,581,179).

22.1 As per claim 52, **Rakib et al.** teaches a receiver (Fig. 28; Fig. 29; CL10, L59-60), comprising:

a demodulator (Fig. 28, Item 460),

a memory system coupled to the demodulator, the memory system logically organized as a captured sample buffer and a decoded symbol buffer (Fig. 28, Item 464; CL7, L13-15), and

a processor coupled to the memory by a communication path (Fig. 28, Item 405), the processor logically organized as an ISI estimator(CL91, L28-31) and a symbol decoder (Fig. 28, Item 468).

Rakib et al. does not expressly teach the processor logically organized as a reliable symbol detector. **Hassan** teaches the processor logically organized as a reliable symbol detector (Abstract, L1-8; CL2, L27-36; CL2, L44-59; CL3, L45-54), because that allows significant enhancement in performance especially with respect to signal-to-noise ratio (CL2, L59-62). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the receiver of **Rakib et al.** with the receiver of **Hassan** that included the processor

logically organized as a reliable symbol detector. The artisan would have been motivated because that would allow significant enhancement in performance especially with respect to signal-to-noise ratio.

22.2 As per claim 53, **Rakib et al.** and **Sakoda** teach the receiver of claim 52. **Rakib et al.** teaches that the symbol decoder is embodied as a subtractive equalizer coupled to a decision unit (CL90, L43-44; CL90, L60 to CL91, L13).

22.3 As per claim 57, **Rakib et al.** and **Sakoda** teach the receiver of claim 52. **Rakib et al.** teaches that the symbol decoder is embodied as a trellis decoder (CL46, L37-49).

23. Claims 54 and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Rakib et al.** (U.S. Patent 6,665,308) in view of **Hassan** (U.S. Patent 6,581,179), and further in view of **Sakoda** (U.S. Patent 6,456,669).

23.1 As per claim 54, **Rakib et al.** and **Hassan** teach the receiver of claim 52. **Rakib et al.** does not expressly teach that the symbol decoder is embodied as a maximum likelihood estimator. **Sakoda** teaches that the symbol decoder is embodied as a maximum likelihood estimator (CL3, L34-41; CL12, L26-29), because when the communication quality differs from data block to data block, the decoding circuit with maximum likelihood estimation would perform estimation more accurately and be able to restore the data bit series more accurately using reliability information than other estimators (CL12, L40-44). It would have been obvious

to one of ordinary skill in the art at the time of Applicants' invention to modify the receiver of **Rakib et al.** with the receiver of **Sakoda** that included the symbol decoder being embodied as a maximum likelihood estimator. The artisan would have been motivated because when the communication quality differed from data block to data block, the decoding circuit with maximum likelihood estimation would perform estimation more accurately and be able to restore the data bit series more accurately using reliability information than other estimators.

23.2 As per claim 56, **Rakib et al., Hassan** and **Sakoda** teach the receiver of claim 54. **Rakib et al.** teaches assigning to occurrence of previously decoded symbols a probability of occurrence equal to one (CL91, L10-13). **Rakib et al.** does not expressly teach that the maximum likelihood estimator assigns to occurrence of previously decoded symbols a probability of occurrence equal to one. **Sakoda** teaches the maximum likelihood estimator (CL3, L34-41; CL12, L26-29), because when the communication quality differs from data block to data block, the decoding circuit with maximum likelihood estimation would perform estimation more accurately and be able to restore the data bit series more accurately using reliability information than other estimators (CL12, L40-44). It would have been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the receiver of **Rakib et al.** that included assigning to occurrence of previously decoded symbols a probability of occurrence equal to one with the receiver of **Sakoda** that included the maximum likelihood estimator. The artisan would have been motivated because when the communication quality differed from data block to data block, the decoding circuit with maximum likelihood estimation would perform estimation more

accurately and be able to restore the data bit series more accurately using reliability information than other estimators.

Allowable Subject Matter

24. Claims 47 and 55 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

25. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Kandasamy Thangavelu whose telephone number is 571-272-3717. The examiner can normally be reached on Monday through Friday from 8:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo Picard, can be reached on 571-272-3749. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to TC 2100 Group receptionist: 571-272-2100.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

K. Thangavelu
Art Unit 2123
June 8, 2005